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The Relationship Between Observed Thermodynamic and Precipitation Properties During Tropical Cyclone Intensity Change

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This presentation examines the thermodynamic and precipitation evolutions of tropical cyclones (TCs) across a spectrum of intensity change rates. With an emphasis on relative humidity and static stability, we investigate how thermodynamic conditions in the midtroposphere and planetary boundary layer evolve during TC intensification, and how these conditions co-evolve with the observed precipitation distribution as seen by airborne radar and satellite-borne passive microwave overpasses. Of most interest are TCs experiencing at least moderate vertical wind shear, as these storms demonstrate a clear precipitation distribution asymmetry, whereby precipitation prior to intensification is initially maximized downshear, while the upshear quadrants are relatively precipitation-free. In this study, we analyze dropsonde data accumulated from NASA-supported hurricane field programs (CAMEX-3, -4, NAMMA, GRIP, and HS3), which provide deep-tropospheric soundings from their DC-8, ER-2, and Global Hawk aircraft. These cases are supplemented with dropsonde data from NOAA aircraft (WP-3D and G-IV), which often flew in cooperation with the NASA aircraft. In the study, we examine multiple cases in which dropsonde data is analyzed in a shear-relative framework. We emphasize the thermodynamic profiles in the upshear quadrants, how they evolve during periods of intensity change, and their relationship to the observed precipitation. We also compare results derived from the dropsonde sounding analyses with soundings from satellite-borne passive microwave retrievals of moisture and humidity.